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The Electronic Battle Box

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ABSTRACT

The Electronic Battle Box is an integrated suite of planning and decision-aid tools specially designed to facilitate Canadian Armed Force Officers during their training and during their tasks of preparing and conducting military operations. It is the result of a collaborative effort between the Defence Research Establishment Valcartier, the Directorate of Army Doctrine (DAD), the Directorate of Land Requirements (DLR), the G4 staff of 1Cdn Div HQ and CGI Information and Management Consultants Inc.

Distributed on CD-ROM, the Electronic Battle Box contains efficient and user-friendly tools that significantly reduce the planning time for military operations and ensure staff officers a better focus on significant tasks. Among the tools are an OrBat Browser and an Equipment Browser allowing to view and edit military organizations, a Task Browser providing facilities to prepare plans using Gantt charts, a Logistic Planner allowing to estimate supply requirements applying complex calculations, and Road, Air and Rail Movement Planners. EBB also provides staff officers with a large set of doctrinal documents in an electronic format. This paper provides an overview of the various tools of the Electronic Battle Box.

1. INTRODUCTION

Modern Armed Forces are highly polyvalent and mobile organizations that are involved, on the national as well as international scene, on a wide variety of operations, including armed conflicts, peace making and peace keeping, humanitary relief and aid to civil authorities missions. These operations require important planning efforts from military staff officers: Mission analysis, development of courses of action (including determining resources requirements), decision or course of action selection, plan development. These activities require from staff officers a good knowledge of the doctrine, military organizations and equipment characteristics. They also necessitate familiarity with a wide variety of complex calculation formulas (found in staff officers' handbooks) used to determine logistic, supply and construction requirements.

Although certain computerized planning tools are in used in the Canadian Forces, these tools only support partly the operation planning process. A large portion of the planning work is done manually or with generic tools (e.g. MS Office suite) poorly adapted to the tasks to be performed. Moreover, the planning process requires good synchronization between various staff officers, but sometimes information sharing is difficult and some tasks are duplicated.

The Electronic Battle Box (EBB) has been developed to provide automated facilities to support the planning process. EBB is an integrated collection of staff data and software planning tools used in the Canadian Army. The name "battle box" refers to the suitcase in which the army troops put the various Staff Officer's Handbooks (SOH) and Field Manuals when they deploy their tactical command posts. The Electronic Battle Box was developed with a purpose of providing a digital version of the various documents and software tools implementing the various military planning calculations found in field manuals. The logo of the suite (Fig. 1) represents the battle box (suitcase) turned into a computer monitor.
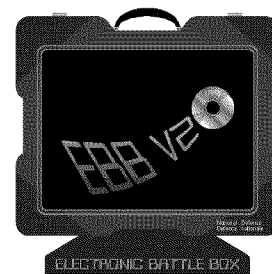

Figure 1 - EBB Logo

The Electronic Battle Box was developed as a cooperative effort between the Directorate of Army Doctrine (DAD), the Directorate of Land Requirements (DLR), the G4 staff of 1Cdn Div HQ and the Defence Research Establishment Valcartier (DREV), with the applications being developed by CGI Information and Management Consultants Inc. The development of the tools followed two years of R&D conducted at DREV on the exploration of advanced command and control concepts, in a project known as Chameleon. The aim of the EBB is to provide commanders and staff with common electronic reference material staff data, and planning tools for use within a command post. The tools have been deployed throughout the Canadian Army and are used in staff colleges. The Australian Department of Defence has also acquired the software to be used as part of the Army Battlefield Command Support System.

2. IMPLEMENTATION APPROACH

The EBB suite has been developed on the Windows 95 / Windows NT platform using Borland Delphi 3.0 Rapid Application Development environment and Paradox Database v7.0. The suite of tools is integrated in a way similar to the MS Office suite and the user interface is based on the MS Office metaphors (e.g. Binder and HCI widgets). Import / export facilities between EBB and MS Office are also provided. The tools have been implemented to be used in a single-user mode. However, export facilities have been implemented to enable the user to exchange Orbats, Plans or Logistic Calculations with other users.

The tools are designed to help the user as much as possible. Highly graphical and user-friendly interfaces have been implemented; complex calculations have been automated and integrated to efficient and productive tools; electronic versions of doctrinal and staff officer's handbooks facilitate the search for information; in many tools, wizards provide the user with a step-by-step walk through on the use of the tools; a full-featured and multimedia on-line help provides the user with useful information both on the tools and on the planning process. Finally, the user interface of all tools is available in either French or English according to the user preference.

Each of the tools is briefly described in the following paragraphs.

3. THE EBB BINDER

Figure 2 - The EBB Binder

The EBB Binder provides access to all the browsers, planning tools and read-only doctrinal data. In addition, users are able to commence the creation and manipulation of operations. Other reference documents are grouped into the Binder for ease of access. The Binder can also be used to exchange operation-related information between users. Figure 2 provides an example of the EBB Binder.

4. THE EQUIPMENT BROWSER

The Equipment Browser (Fig. 3) may be used to create, modify, delete, or view all the information related to doctrinal document. The equipment includes vehicles, trailers, shelters, weapons, ammunition, aircraft, EW assets, communications equipment, generators, engineer equipment and medical equipment.

Figure 3 – The Equipment Browser

Among the main features of the Equipment Browser are the following:
- Equipment is divided into categories and presented using a tree view;
- For each equipment selected, the user can view various types of information: generic, vehicle characteristics, weapons and ammo for this equipment and equipment drawings with legends;
- The user can do a search on equipment names;
- Various equipment characteristics are used in the logistic and movement calculations.

5. THE ORBAT BROWSER

The OrBat Browser allows users to create, modify and display all the information relating to doctrinal OrBats. OrBats may be created from scratch, or by copying elements from existing OrBats. Equipment and Personnel can also be assigned to new organizational structures.

The OrBat Browser has a large number of interesting capabilities:
- The OrBat is presented both using a tree view and an Organization chart representation.

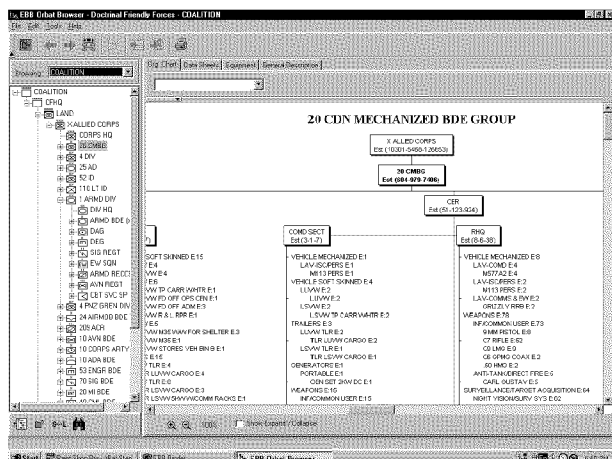**Figure 4 – The OrBat Browser (STANAG 2525 Symbology)**

Figure 5 – The OrBat Browser (Equipment List)

- The user can customize the Org Chart representation, for example by presenting unit information using APP6 or STANAG 2525 symbology (Fig. 4) or without the symbology but with lists of equipment (Fig. 5). The user can display the number of levels as desired, display the Org Chart in four different layouts and maximize the viewing area by showing only the Org Chart. The Org Charts can be exported to the clipboard then imported into MS Word or MS PowerPoint.
- The user can create a new OrBat simply by importing an existing one and doing a drag and drop of the needed formations or units. The user can then easily readjust the personnel quantities and the list of equipment.
- Tables of Organizations and Equipment can be presented in a spreadsheet format. Both establishment and actual quantities can be presented. The user can customize the spreadsheet display by collapsing or expanding both rows and columns and interestingly, this can be exported to MS Excel.

6. THE TASK BROWSER

The Task Browser (Fig. 6) is used to plan tasks,
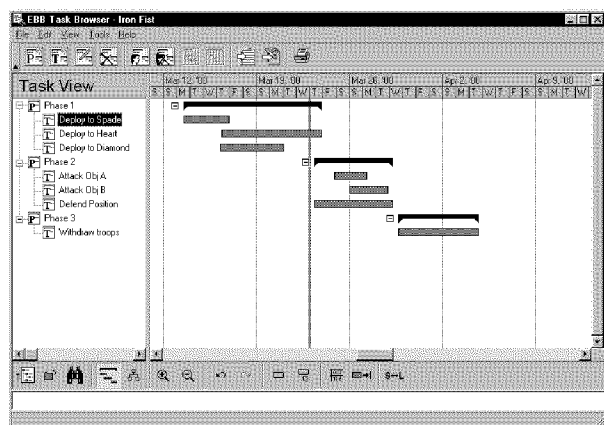
Figure 6 – The Task Browser
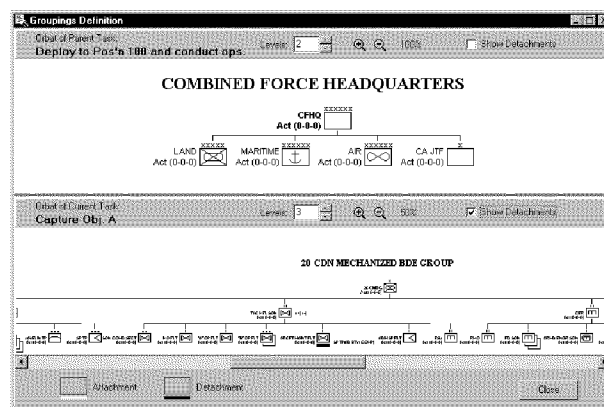
Figure 7 – Groupings Definition

which are grouped into phases, and to visually represent them as a Gantt chart. The browser allows for the assignment of a specific unit in the defined OrBat to a particular task. It also allows for the tactical grouping of units associated with specific tasks (Fig. 7). These groupings are subsequently used in the calculations for logistic support.

When defining phases and tasks, the user can set various parameter that will be used in the calculations. For example, based on the climatic conditions (e.g. arctic, tropical), he can set different food consumption requirements. Based on the type of tasks (e.g. attack or defend), the user can also set different ammunition consumption rates and different attrition rates.

For the Gantt chart representation, the user can select two modes of display: the first mode is to display the tasks on the left and show on the Gantt chart which units are involved on each task; the second mode is to display the OrBat on the left and show on the Gantt chart the various tasks the units are doing. The user can adjust the task duration graphically and move tasks on the Gantt chart. When doing so, the software will warn the user if a unit is committed to two tasks during the same period. The granularity of the time scale in the Gantt chart is automatically adjusted as the user zooms in or zooms out. The user can also plan in absolute mode or in relative mode (e.g. D-days, H-hours).

7. THE LOGISTIC PLANNER

The Logistic Planner calculates the supply needs for the selected units in order to accomplish their specific tasks. It computes the number of pallets required to transport the supplies. These calculated staff checks can then be manually adjusted to consider contingencies. Figure 8 shows an example of the ammunition, Petroleum-Oil-Lubricants and Subsistence requirements for a certain logistic option.

The Logistic Planner relieves the user from complex calculations. The calculations are based on formulas found in staff officers' handbooks and take into account various parameters: the tasks parameter set (e.g. climatic conditions, attrition rates), the resources (personnel and equipment) for

Figure 8 – The Logistic Planner

the units carrying each task, the equipment consumption (e.g. POL, ammunitions), the tasks duration.

8. THE LIFT PLANNER

The Lift Planner helps determine the number of vehicles required to move all the supplies calculated by the Logistic Planner and compares this to the number of vehicles available in the tasked units. It uses the list of equipment assigned to the units selected to carry the supplies. An equipment must respect four conditions to be considered: it must be marked as cargo; it must have a NATO pallet capacity greater than zero; its empty weight must be specified; and either its maximum weight on road or in cross country must be specified.

The tool presents the user with a surplus/lack indicator. The surplus/lack information is the difference between the equipment transportation capacity and the quantity of supply to transport, in terms of weight and number of pallets. Thus, a negative number indicates a lack of equipment to transport all the supplies.

Figure 9 – Example of a Road Movement Table

9. THE ROAD MOVEMENT PLANNER

The Road Movement Planner provides the user with a detailed road movement schedule in the form of a road movement table. This tool can also be used for dumping planning.

Although this version of the tool does not use an electronic map background or a geographic information system, the Road Movement Planner allows the user to provide information on a road network with distances and the type of roads, then to specify itineraries. Parameters can be set for road movement by day or night and various road movement options can be calculated.

Orders of march can be defined for a set of units and its fleet of vehicles. The movement schedule for each vehicle can then be computed (Fig. 9). It should be noted however that the tool does not resolve the schedule synchronization of two road itineraries merging at a junction point.

10. THE AIR MOVEMENT PLANNER

The Air Movement Planner calculates the number of aircraft required to transport the units' personnel, equipment and/or supplies. It is designed to give an estimate of the required number of aircraft based on weight and volume considerations and should not be considered as a detailed aircraft-loading tool.

11. THE RAIL MOVEMENT PLANNER

The Rail Movement Planner provides solutions for loading a train depending on the number and type of train cars available, the equipment to load and some other criteria set to the users' preferences. It performs this function iteratively, creating and evaluating options until a good solution is obtained. Unit cohesiveness is maintained.

The Rail Movement Planner is implemented using genetic algorithms. On each iteration, a new set of solutions is generated. The user can view these solutions graphically, with an indication of the various sets of train cars used and of the vehicle(s) loaded on each train car (Fig. 10). Each solution is weighted according to their fitness, for example considering the number of vehicles left on the dock or the total number of

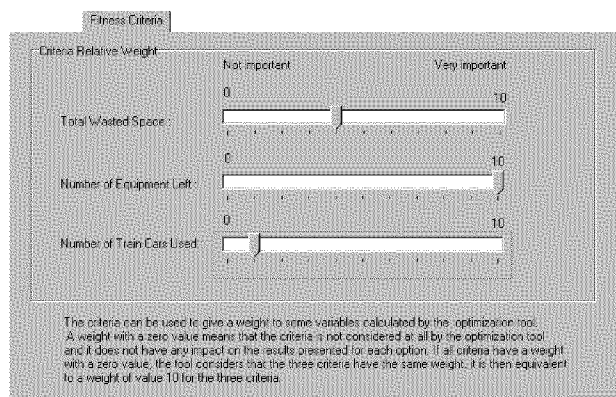**Figure 10 – Example of the Rail Movement Planner**

Figure 11 – Gauges for setting user priorities (weighting factors)

meters of unused space on the train cars. The user can establish his priorities when determining the fitness values (Fig. 11). The good solutions are used to create the new generations of solutions. Three techniques are used as part of the genetic algorithms: clone copies of good solutions are created, mutation of good solutions are computed or two good solutions (two good parents) are used to create a new solution (child). Genetic algorithms are very good when ones want to take into account multiple constraints. It allows to generate rapidly a good solution, but not necessarily the optimal solution.

12. CONCLUSION

The Electronic Battle Box is an efficient set of planning tools for the Armed Forces. It has tangible benefits for military staff officers. First it diminish considerably the time required for various planning tasks. Certain tasks that used to require 12 hours to carry out can now be done within an hour with EBB. Moreover, as the tools are integrated in a coherent suite and as the complex calculations have been automated, the risk for errors is significantly reduced. Finally, staff officers can now focus on essential military planning activities rather than on clerical work.

The manual planning process brings so much constraints that one sole planning option is often considered and this is seldom optimal. EBB tools allow to consider various options, perform some 'what-if' scenarios, and select the best option. EBB also provides facilities to share the results of some options with other staff officers, diminishing duplication of work and ensuring a better coordination. In the next version of EBB, a multi-user architecture will be implemented so that users can even have a better interaction in a collaborative mode.

Finally, staff officers in military training centers and staff colleges are better equipped to provide training on military doctrine and the operation planning process. They can better rely on information technology, prepare and reuse more easily military scenarios and exercises (including OrBats) and can focus on the real training objectives. Having access to a central repository of doctrinal data on a compact and easily accessed medium (the doctrinal documents on EBB CD-ROM) also facilitates the task of the training staff.

Discussion – Paper 4

This appeared to be a very good tool for entering and maintaining data, but not so good for creating executive summaries or reporting. It is effective at the strategic level.

Suggestions for improvements included:
- direct link to manuals or URL
- Use visualisation for reporting.
- Hyperbolic trees

Potential commercial uses could be displaying organizational charts, and resource and task planning. (i.e. police, fire departments)

Visualisation tools could be used to highlight aspects of the org, for example, weaknesses in the organization.